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Original Research Article

Electricity production, Foreign Direct Investment, Government Effectiveness, and Economic Growth in Cameroon

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Abstract: The purpose of this paper is to examine the relationship between electricity production, foreign direct investments inflows and government effectiveness on economic growth in Cameroon and identify their direction .The vector autoregressive regression (VAR) and granger causality models are employed to examine the short-run, long-run and causality relationship to annual data time series from 1996-2013.The results indicate non-existence of long-run relationship between electricity production, foreign direct investments inflows and government effectiveness and economic growth. In short-run electricity production and government effectiveness are statically significant at 10% level and have positive relationship and negative relationship respectively with economic growth. However, the foreign direct investment is not statistically significant but have positive relationship with economic growth. The results of the granger causality show that all probability values are greater than 0.05. We conclude that there is no bi-direction relationship between dependent variables, economic growth and the remaining varaiables included in our model.
Keywords: Electricity production, Foreign Direct Investment, Government Effectiveness, VAR, Economic Growth, Cameroon

INTRODUCTION

Cameroon is projecting to become an emerging economy country by 2035 through its industrial development. This will necessitate the reliable production and distribution of energy to be considered Vital for business to be undertaken, for the economy to run successfully and standard of living of the people to be enhanced. In this respect, Cameroon has massive energy potential. Due to its geographic location, Cameroon is ranked as the second largest producer of hydroelectric power in Sub-Saharan African countries behind Democratic Republic of Congo. This potential rests only to be developed to over-increasing demand and to lessen the uncertainty in the sector. The authorities have set up massive programmes to enhance and increase the distribution of supply of electrical power by constructing numerous hydroelectric dams such as the Lom-Pangar, Memve'le and Mekin dams as well as gas power station in Kribi, drilling to generate thermal power, and even resorting to new and sustainable energy sources. According to African Economic outlook 2005-2005, the charge and quality of causes of electricity production in the country are critical problems for domestic business. The national power company (AES-Sonel) has a franchise on generators that projected to produce in 2005, after the inaugural of thermal plants in Limbe (85 MW) and Logbaba (13MW), a total of 932MW [i]. Domestic businesses criticize that power supplies are costly and insufficient and the deficit was projected at 180 MW in 2004. Cameroon has great hydroelectric prospective which is poorly exploited. It is not adequately reimbursed for by suitable thermal capacity, which leaves the country at the mercy of the weather. Electricity production can be defined as the entry is the annual electricity generated expressed in kilowatt-hours. The discrepancy between the amount of electricity generated and/or imported and the amount consumed and/or exported is accounted for as loss in transmission and distribution.[ii] Cameroon's electricity production is mainly generated by hydroelectric and thermal power stations and the renewable energy Production is in its infancy. The three hydroelectric power plants presently in operation have a total installed capacity of 732 MW. The Songloulou power station, which was commissioned in 1991, with an installed capacity of 384 MW; the Edea power station, composed of three parts which were commissioned in 1957, 1958 and 1975, with a combined installed capacity of 276 MW; and the Lagdo power station,

commissioned in 1983, with an installed capacity of 72 MW[iii]. For many years, electric power was rationed through power outages. This circumstance has led to a substantial drop in the living conditions of households and disturbed economic activity, mostly in the secondary sector. In fact, with inadequate power supply, many industries could not run to full capacity and investors were not inspired to establish operations in the country. In that association, some hydroelectric power stations are being constructed, including: the Mekin power station, with an installed capacity of 15 MW, which was commissioned in 2015; the power Lom-pangar power station, with an installed capacity of 30 MW, which was planned to be commissioned in the fourth quarter of 2015 power station, with an installed capacity of 211 MW, which was ended in January 2017.[iv] Based on the statement about the country we can note that many efforts have been conducted by the government to increase the electricity production in Cameroon. In the lights with effort done in domain of electricity, it is very important to conduct an empirical study to check the relationship between electricity production and economic growth via granger causality test. We consider other variables such as foreign direct investment and government effectiveness. By doing so we have three catalysts of growth into one model, electricity production led growth, foreign direct investment led growth and government effectiveness led growth. Therefore, the findings of this study most reliable, robust well policy-orientated. To examine an existence of long -run relationship between electricity production, foreign direct investment and government effectiveness the vector auto-regressive was employed. For better policies decision-making, the granger causality test will be employed to verify the direction of causality between the variables specified in our model. This paper is organized as follows. Following the introduction in section I, the section 2 present the literature review. Section III sets the methodology used in this paper. Section IV discusses the empirical results, while section V concludes the study.

REVIEW OF LITERATURE

According to (Stern. D, 2004): the importance of energy supply in the modern economy cannot be neglected noted that electricity is a factor of production and plays a complementary role rather than its role in production process and replacement. Electricity production plays most vital role in the economic growth, poverty eradication, progress and development. An efficient source of electricity supply is vital issue for all countries today. A sustainable economic development crucially relies on the long -run availability of from different sources such as: environmentally friendly, affordable and accessible. The supply of electricity in Cameroon is an important factor in all its economy sector. Electricity is a necessity and which access to Cameroon is recognized as a right. It has become essential to everyday life and is an essential component of business competitiveness. It is therefore obvious that no economic development is conceivable without available and accessible electrical energy in quantity and quality. The relationship between electricity production, foreign direct investment, government effectiveness and economic growth as important policy implementations is little researched in the world and none in Cameroon. Most of the previous studies were conducted on electricity consumption, foreign direct investment, government effectiveness and economic growth. In this part, we shall review the relationship between electricity production and economic growth, as well as other related variables include in our model. (Ellahi. N, 2011): analyzed the impact of electricity supply and industrial sector development for economic growth of Pakistan using Auto Regressive Distributed Lag (ARDL) approach to find short run as well as long run estimates found that labor, capital, electricity supply and industrial sector development play an important role for improving the economic growth of Pakistan and shortage of electricity results in dismal performance of industrial sector.(Emm H et al, 2009)investigated the impact of electricity generation on countries economy efficiency by using a sample of 42 World and East Asian countries covering the period of 1996 to 2006. The results show that there is an inverted U-shape relationship between electricity generation and countries' economic efficiency. Finally, the authors argued that the electricity generation-economic efficiency relationship depends also on the structure of the economy. (Nwankwo OC et al, 2013) examine the effect of electricity supply on economic development and likewise the effect of electricity supply on industrial development by employing a multiple regression model found that electricity supply has a positive relationship with economic growth. He suggested that electricity production and industrial development should be given priorities in purpose affect fully the economy development. (Morimoto R et al ,2004). investigated the impact of electricity supply on economic growth in Sri Lanka, found that the expected increase in economic output due to increased electricity supply. (Chiazoka A et al ,2013) examined the impact of electric energy supply on the industrial sector productivity in Nigeria covering the period of 1970 to 2010. The result shows that national energy supply have no significant impact on industrial productivity. (Khobai H et al, 2016) examined the short and long run relationship between economic growth, electricity supply, trade openness, electricity prices, employment and capital in South Africa within a multivariate framework using the autoregressive distributed lag bound testing over the period of 1985-2014 found that that economic growth, electricity supply, trade openness, electricity prices, employment and capital are co-integrated. The importance of foreign direct investment (FDI) on

economic growth cannot be also neglected. FDI has a major role to play in Cameroon's economic development. FDI act as long term of advanced and developed technologies, global management practices, source of capital and unemployment reduction. The relationship between foreign direct investment and economic growth has been largely researched. (Rehman. N, 2016) investigated the relationship between FDI and economic growth covering the period of 1970 to 2012 using Vector error correction model (VECM) found that FDI have positive impact on economic growth. (Mahembe E et al, 2016) examined the causal relationship between inward foreign direct investment and economic growth in Southern African Development Community (SADC) countries over the period 1980-2012 as well the causal relationship between FDI inflows and economic growth on the level of income using panel data analysis and granger causality test for middle income-countries found a uni-directional causal flow from GDP and not vice versa but in case of case of causality, there is an independence. They concluded that FDI don't lead to growth in The Southern African Development Community (SADC). (Zhao C et al ,2007) examined the causality between FDI and economic growth through vector Autoregression (VAR). the result indicates no-bidirectional causality between FDI and economic growth. (Sothan.S,2017) investigated relationship between foreign direct investment and economic growth covering the period of 1980-2014 using Granger causality test based on the vector error correction model found a causal impact of FDI on Cambodia's economic growth. Finally, he concluded that the growth impact of FDI is sufficiently supported in Cambodia. (Fadhil M et al, 2015) identified the role of FDI inflows in Malaysia economic growth using a proposed endogenous growth model covering the period of 1975 to 2010 found that FDI inflows contribute strongly to the economic growth. According to the World Bank website 2018 government effectiveness captures the perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies also plays an important on economic growth. There are few studies which have considered the relationship between government effectiveness and economic growth. (Alam et.al, 2017) examined the relationship between government effectiveness and economic growth using Generalized Method of Moments (System GMM) in 81 countries found a significant positive effect of government effectiveness on economic growth.

METHODOLOGY

Data source and sample frame

This study uses the secondary yearly data of EP, GR, FDI and GE This study covers the period of 1994-2015. The data of GDP growth and net foreign direct investment were collected from World Development Indicators database with the source from World Bank National Accounts data, and OECD National Accounts data files. The data of government effectiveness was collected from the worldwide governance indicators based on 31 underlying data sources which are available at www.govindicators.org. In this section, an appropriate economic model is used to establish the relationship between electricity production, foreign direct investment, government effectiveness and economic growth. The relationship between economic growth and our variables of interest is follows:

Empirical model

In line with the reasons behind the choice of our variables, the following Baseline model is:

$$GR_t = f(EP_t, FDI_t, GE_t)\varepsilon_t \quad \text{.....(1)}$$

Where:

GR = Economic growth as proxy for economic performance
EP = Electricity production from hydroelectric sources (% of total)
FDI = foreign direct investment proxy of net inflows (% of GDP)
GE= government effectiveness measured by the index of government effectiveness estimate rating
From -2.5 to 2.5
In a more explicit form, the models can be written in the natural logarithm to transform the variables into the same unit and base. Thus:

$$EG_t = \alpha_0 + \alpha_1 EP_t + \alpha_2 FDI_t + \alpha_3 GE_t + \varepsilon_t \quad \text{.....(2)}$$

Where α_1, α_2 and α_3 >**0**

The electricity production is of great interest to economists as well as policymakers because of its significant policy implication. Normally electricity production will lead to the electricity consumption and we assumed that this consumption support growth hypothesis that is uni-directional causality running from

electricity consumption to economic growth. We expected a positive and significant relationship between economic growth and electricity production. the Foreign direct investment on of the key element of gross domestic product has vital role for economic growth. Foreign direct investments net inflows will bring about a higher investment return in the Cameroonian's economic growth. We expected a significant and positive relationship between FDI and economic growth. The government effectiveness likely promotes confidence between local people as well foreign investors because decisions are made in transparent and accountable way will encourage investment which in turn will affect the economic growth.

Estimation procedure

A unit root test is the test for non-stationarity to avoid spurious regression results. The Augmented Dickey Fuller (ADF) test and the Philips Perron (PP) test will be employed. To catch any possible serial correlation, enough lag will be including in our estimating equation (Dickey and fuller, 1979). After the unit root test, the existence of long-run relationship among our variables will be tested using the cointegration test by Johansen (1988). The two tests for co-integration are used in our analysis namely, Unrestricted Co integration Rank Test (Trace) and Unrestricted Co integration Rank Test (Maximum Eigenvalue). The granger causality is also performed to see if there is short-run relationship between the dependent and independent variables (Granger, 1969). The result of cointegration show no cointegration which implies the use of vector Autoregressive (VAR). Moreover, impulse response is performed can be interpreted as the response to stage impulse where the same shock happens in every period from the first. Finally, diagnostic tests are tests used to examine the goodness of the model for predictions. This includes Breusch-Godfrey Serial Correlation LM Test, Heteroskedasticity Test of Breusch-Pagan-Godfrey, Histogram and LM Test Normality as well the stability test through CUSUM and CUSUM squares.

RESULTS AND DISCUSSIONS

The table 1 presents the summary of the descriptive statistics of our variables. It helps us to have an idea on the trend, normality and stability of the variables used in our model. The standard deviation, skewness, kurtosis, Jarque-Bera and probability confirmed that the variables are stable and normal.

Table-1: Descriptive statistic

	GR	EP	FDI	GE
Mean	3.931420	86.53727	1.532219	-0.883461
Median	4.046636	94.79146	1.591663	-0.876556
Maximum	5.561688	98.90805	4.622171	-0.653435
Minimum	1.931851	69.44492	-0.147760	-1.370249
Std. Dev.	0.987680	12.59199	1.255336	0.172268
Skewness	-0.323713	-0.229395	0.622006	-1.177432
Kurtosis	2.473865	1.138868	3.119251	4.651763
Jarque-Bera	0.521984	2.755724	1.171340	6.205278
Probability	0.770287	0.252117	0.556733	0.044930
Sum	70.76557	1557.671	27.57995	-15.90230
Sum Sq. Dev.	16.58371	2695.491	26.78976	0.504497
Observations	18	18	18	18

Authors' construction based on Eviews 9

Unit root test results

The results for ADF and PP are presented in the table 2 and 3. The variables which are non-stationary in level become stationary in first difference. The first difference in the case of ADF including in test equation is intercept. Hence, the of unit roots test are done to avoid spurious regression.

Table-2: Unit root test by Augmented Dickey Fuller (ADF)

	At level		First difference		Included
Variables	t. stat	Prob	t. stat	Prob.*	
GR	-1.333366	0.5889	-3.490018	0.0227	Intercept
EP	-0.512210	0.8661	-3.606678	0.0182	intercept
FDI	-4.411119	0.0036	-7.567659	0.0000	Intercept
GE	-4.494745	0.0030	-3.657812	0.0186	Intercept

***, **, * indicates rejection of the null hypothesis of Unit Root Test at 1%, 5% and 10% levels of significance
Source: Prepared by the authors, based on Eview 9

Table-3: Unit Root Test by Phillips Perron (PP)

	At level		First difference		Included
Variables	t. stat	Prob	t. stat	Prob.*	
GR	-1.333366	0.5889	-3.497917	0.0224	Intercept
EP	-0.542772	0.8594	-3.590862	0.0188	intercept
FDI	-4.412135	0.0035	-15.49574	0.0000	Intercept
GE	-4.526376	0.0028	-11.49131	0.0000	Intercept

***, **, * indicates rejection of the null hypothesis of Unit Root Test at 1%, 5% and 10% levels of significance
Source: Prepared by the authors, based on Eview 8

Cointegration result

The table 4 and 5 presented the results of co-integration test of unrestricted Co integration Rank Test (Trace) and unrestricted Co integration Rank Test (Maximum Eigenvalue). The estimated Eigen value, trace statistics, the critical value and the probability are also presented. Both The trace statistics test and Max-Eigen indicate no co-integration in our model. The trace statistics is (34.30368) less than the critical value (47.85613) at 5% level of significance. Maximum Eigenvalue show also show the statistic (20.76109) less than the critical value (27.58434) means that the GDP growth, electricity production, foreign direct investment and government effectiveness are not co-integrated or moving toward equilibrium. Therefore, there is no long-run relationship, thus VAR is used to estimate our results.

Table-4: Unrestricted Co integration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.726805	34.30368	47.85613	0.4853
At most 1	0.430829	13.54259	29.79707	0.8653
At most 2	0.192454	4.525403	15.49471	0.8569
At most 3	0.066750	1.105310	3.841466	0.2931

Trace test indicates no cointegration) at the 0.05 level and * denotes rejection of the hypothesis at the 0.05 level.
Source: Prepared by the authors, based on Eview 9

Table-5: Unrestricted Co integration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.726805	20.76109	27.58434	0.2909
At most 1	0.430829	9.017185	21.13162	0.8310
At most 2	0.192454	3.420093	14.26460	0.9149
At most 3	0.066750	1.105310	3.841466	0.2931

Trace test indicates no cointegration) at the 0.05 level and * denotes rejection of the hypothesis at the 0.05 level.
Source: Prepared by the authors, based on Eview 9

Granger Causality Test

The table 6 presents the result of the granger causality. Since all probability values are greater than 0.05, we conclude that there is no bi-direction relationship between dependent variables economic growth and the rest of remain variables including in our model.

Table-6: Granger causality test

Null Hypothesis:	Obs	F-Statistic	Prob.
EP does not Granger Cause GR	16	0.31206	0.7382
GR does not Granger Cause EP		1.77743	0.2143
FDI does not Granger Cause GR	16	1.65180	0.2359
GR does not Granger Cause FDI		0.16492	0.8500
GE does not Granger Cause GR	16	0.49045	0.6251
GR does not Granger Cause GE		0.08724	0.9171

, * denote rejection of the hypothesis at the 0.05 and 0.10 levels
Source: Prepared by the author, based on Eview 8

Table-7: Estimated results for short-run

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EP	0.023250	0.012397	1.875402	0.0803*
FDI	0.088509	0.172055	0.514423	0.6145
GE	-2.022205	1.132694	-1.785306	0.0944*

, * denote rejection of the hypothesis at the 0.05 and 0.10 levels
Source: Prepared by the author, based on Eview 8

The table 7 showed that electricity and government effectiveness are statistically significant at level of 10% and have positive relationship and negative relationship respectively with GR. The foreign direct investment is not statically significant but have positive relationship with economic growth.

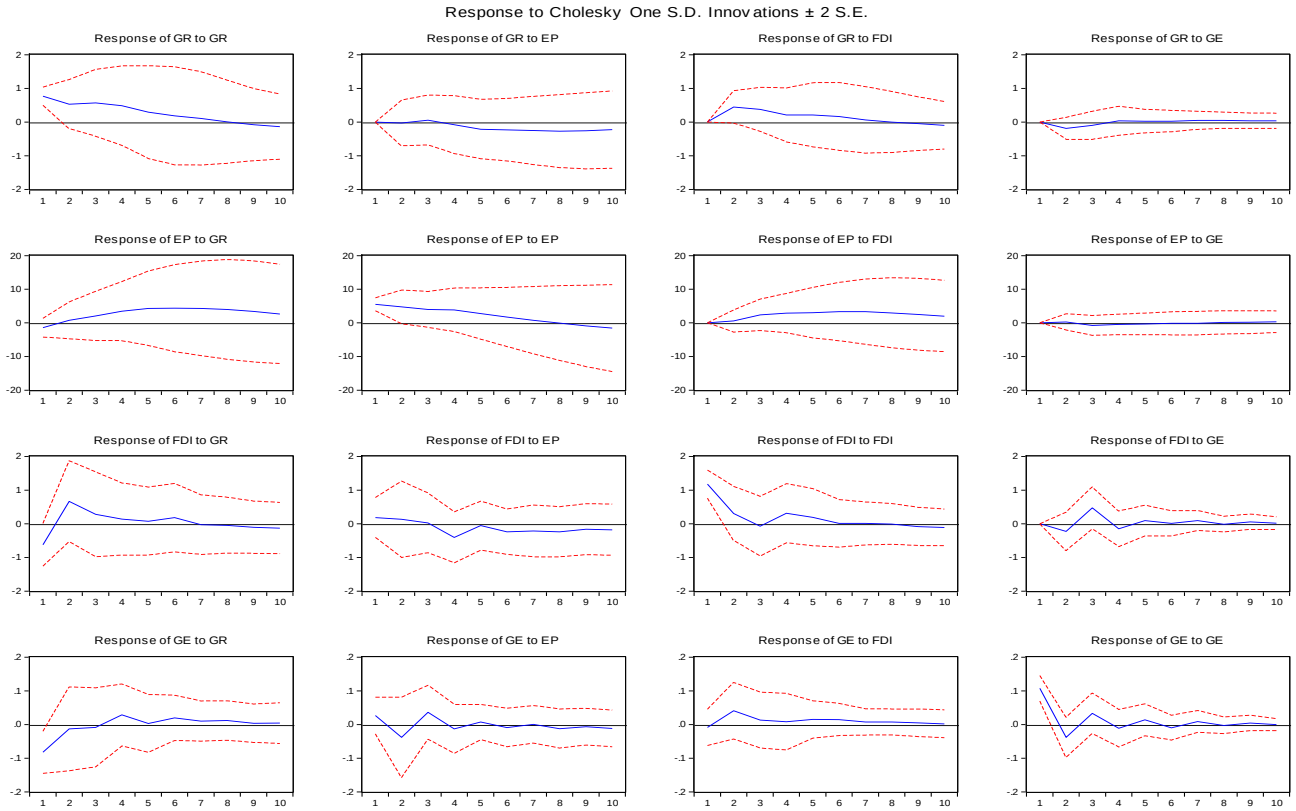

Fig-1: Impulses responses
Source: Eview 9

The figure 1 presents the results of impulse responses from electricity production, foreign direct investment and government effectiveness. [0-5] is considered as short-run period and [5-10] as long-run period. The impulse responses from electricity production is negative at the beginning of the short-run but quickly started to be positive in long -run mean that the efforts which is conducted by Cameroonian government to increase electricity supply will affect the economic growth of country in long -run. It confirms the result of granger causality test statistics which stressing that there is not short -run between electricity production and economic growth. The impulse response of foreign direct investment to economic in short-run is negative before starting to increase then decrease in long-run. Many efforts should be direct in the domain of business environment to increase the confidence of foreign investors. Government effectiveness in short-run is negative and start to improve to become positive in long run. The impulse response from economic growth to electricity production is negative in long-run. The impulse response from economic growth to growth to foreign direct investment is positive from year 0-9 mean in short and long run. But started to decrease in ninetieth year before to be negative. The impulse response of economic growth to government effectiveness is negative in short-run then become positive and close to zero in long -run and continue to be positive.

Diagnostic test

The diagnostic results of the underlying VAR model for long-run elasticities and supporting statistics. The table 8 and 9 as well the figures 6, 7 and 8 for long-run model successfully passed all tests of normality, serial correlation, conditional heteroskedasticity, as well

as the residually are normally distributed and finally the stability test.

Table-8: Breusch-Godfrey Serial Correlation LM Test

F-statistic	2.217827	Prob. F (1,14)	0.1586
Obs*R-squared	2.461383	Prob. Chi-Square (1)	0.1167

Table-9: Heteroscedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.755145	Prob. F (3,14)	0.5375
Obs*R-squared	2.507024	Prob. Chi-Square (3)	0.4740
Scaled explained SS	2.286497	Prob. Chi-Square (3)	0.5151

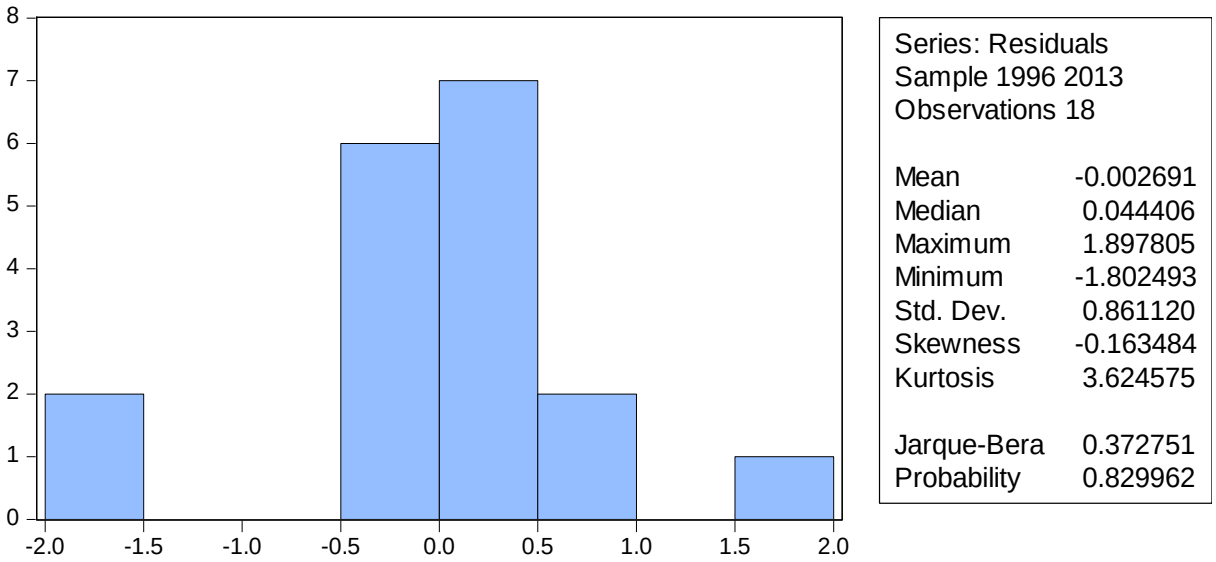

Fig-6: histogram – normality test

Source: generated from Eviews

Stability test

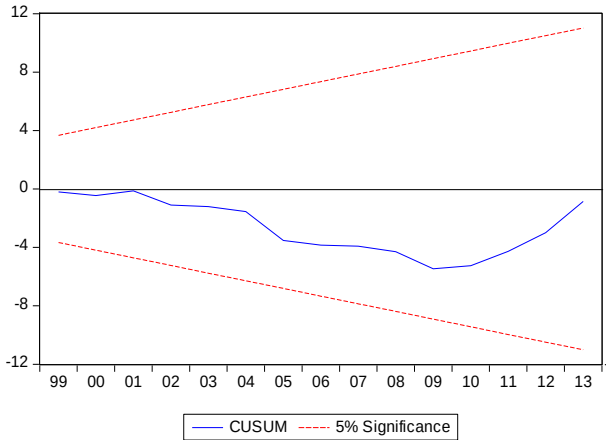

Fig-2: CUSUM

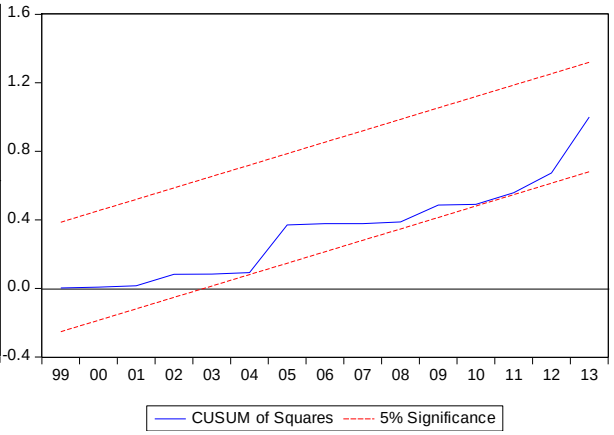

Fig-3: CUSUM squares

CONCLUSION

Electricity production is inevitably essential for economic growth for much African countries.an adequate electricity production and distribution would impact the production of enterprises at low cost which then leads to low price of demand of goods and services. This situation makes electricity extremely important for Cameroon which electricity generation is mainly from thermal and hydro. The relationship between electricity production, foreign direct investment and government effectiveness has been analyzed in this paper. The study employed the Vector Autoregression and granger causality to examine the long and short run relationship. The results of analysis indicate that there is no long –run relationship between our Independent variables and economic growth. In

short –run Electricity production and government effectiveness are statically significant and have positive and negative relationship respectively with economic growth. The results of the granger causality test also show no bi-directional causality among all the variables. As an important market to not only central African countries but also for the rest of African countries, therefore efforts should be made to increase more and more the electricity production for a long-run sustainable economy development. Finally, government effectiveness needs to be improved as well as the attractiveness of foreign direct investment inflows in the country.

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